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ABSTRACT

This study examined the effects of pretraining Chicano and non-Chicano seventh-grade students using items parallel to those appearing on tests. The sample was 44% Chicano and 56% non-Chicano. Prior to instruction on factors and primes, all seventh-grade students in a school were given an Arithmetic Reasoning Test and a Missing Words Test as pretests; before pretesting, half of the students received pretraining on Arithmetic Reasoning and half on Missing Words. Following instruction, these tests were given again with a test on factors and primes. Data analysis indicated that pretraining significantly improved the reliability of the Arithmetic Reasoning Test for Chicano students; no differences in reliability were found for non-Chicanos nor on the Missing Words Test. Regression analyses indicated that pretraining also improved the prediction power of the test for Chicano students. (SD)

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STANFORD MATHEMATICS EDUCATION STUDY GROUP (SMESG)
Working Paper No. 14

The Effect of Pretraining Chicano Students on Parallel Test Items Before Administration of a Mathematics Predictor Test.

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Introduction

With the cooperation of the San Jose Unified School District and Herbert Hoover Junior High School[1], this study was conducted by the Stanford Mathematics Education Study Group in June of 1975. The study is similar to a study by Bernal (1971).

Bernal (1971) investigated the role of task familiarity in relation to scores of Chicano students on standardized tests. He found that Chicano students benefitted significantly on mental ability tests from an intervention which permitted them to learn the test-marking strategies. Anglo students did not gain from the intervention.

The experimental treatment of this study, pretraining on parallel items before administration of the predictor tests, was similar to Bernal's (1971) treatment. This study used two experimenters and did not incorporate a bilingual approach as Bernal (1971) did. The decision to disregard a bilingual approach was made after reviewing the literature concerning language and cultural factors in tests (Davis & Personke, 1968, 1969; Keston & Jimenez, 1954; Massarotti, 1971; Palmer & Gaffney, 1972; and Swanson & DeBlassie, 1971).

Population

Herbert Hoover Junior High School was selected for this study because of its large Chicano student population. Only seventh grade students were involved in the experiment because the instructional unit, Factors and Primes, was appropriate for seventh grade Chicano students. Approximately 44% of the seventh graders used in this study were classified as Chicano. All English as a Second Language (ESL) students were eliminated from the study due to reading difficulties. 56% of the seventh grade population was a combination of Anglo, Black, Oriental, and others.

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Procedure

A. Pretraining -- Pretesting

On the first day of pretesting, each of the eight classes was randomly divided into two groups. Group A received pretraining on the Arithmetic Reasoning Test, while Group B was administered the test using standard procedures. Group A relocated in a room near the regular classroom, and the experimenter pretrained Group A on the strategies of marking the test. The pretraining occupied approximately 20 minutes of the class period.

Each student in Group A was handed a mimeographed sheet containing one example of a single operation problem parallel to the items on the Arithmetic Reasoning Test. The experimenter then read the problem, explaining to the students that they should ignore the four answer choices the first time through the problem. The students then tried to do the problem. After the student tried the problem, he compared his algorithm with the answer choices. The students were then handed a second mimeographed sheet, containing the second example to be used as a pretraining item. This time the students were asked to work the problem by themselves. After they reached a conclusion, the experimenter asked a few of them to explain how they arrived at their answer. During this time, the experimenter corrected their procedures or strategies if there were misunderstandings or misconceptions about the strategy. A third problem was then handed out to the students, and they again worked through the problem and discussed the procedure with the experimenter. Next, the experimenter discussed the strategy for a compound problem (see appendix for example). Only two examples were given of a compound problem. The students then returned to their regular classroom and the Arithmetic Reasoning Test was administered to the entire class. This procedure was used for all eight classes in the study.

On the second day of pretesting, Group B was pretrained on the Missing Words Pretest, and Group A received the standard administration of the test. Group B relocated in a room near the regular classroom with the experimenter. The experimenter gave the students a mimeographed sheet containing one example of a Missing Words item. This example contained the complete paragraph with particular words underlined.

On the same sheet, the paragraph appeared with the underlined words deleted and replaced by blanks. The experimenter explained how the Missing Words Test was developed, and gave the students general instructions as to how to mark the test.

The experimenter explained the strategy of reading the entire paragraph first, then trying to fill in the missing words. The fact that there is only one correct word for each blank was stressed. A second mimeographed sheet was then handed to the students; this sheet contained an example of another Missing Words problem.

The students were asked to read the entire paragraph with the blanks--then try to fill in the missing words. The experimenter then asked the students to explain their strategy when they completed the problem. Two more Missing Words Problems were then given to the students. After pretraining, the students returned to their regular classroom and the Missing Words Pretest was administered to the entire class. This procedure was used for all eight classes in the study.

On the first day of pretesting, Group B was administered the Computation and Comprehension Pretests while Group A was pretraining. On the second day of pretesting, Group A was administered the Computation and Comprehension Pretests while Group B was pretraining. On the third day of pretesting, all students were administered the Factors and Primes Pretest.

The Missing Words Test was designed to measure the ability to read mathematical prose. An account of the development of this test is found in SMSG Wroking Paper No. 11, by Roger Jarvis. The Arithmetic Reasoning Test (also named Necessary Arithmetic Operations) has been administered to both Anglo and Chicano students. The results of one study produced a high reliability coefficient and a high correlation with mathematics achievement for Anglo students, but a low reliability for Chicano students (SMSC Working Paper No. 5). A second study produced almost identical reliabilities for Anglo and Chicano students, but a very low correlation with mathematics achievement for Chicano students (SMSG Working Paper No. 12).

B. Pre-Program

Also on the third day of the study, the booklet entitled "Programmed Arithmetic" was given to the students. This five page

booklet illustrates the use of programmed texts. Each class was directed by a member of the SMESG. The programmed Arithmetic booklet was read by the SMESG member while the class followed in their own booklets.

C. Instruction

After pretraining, pretesting, and discussion of the programmed booklets, the students were given a text on Factors and Primes. This was their classroom instructional material for 5 days. Each student proceeded at his/her own rate through the text. When the student completed the text, the posttest battery was administered. After completion of the posttest battery, the students worked on Factors and Primes, Part II, but this was not included in the study.

D. Posttests

The posttest battery consisted of a Factors and Primes Posttest, the Comprehension Test (identical to the pretest), and the Missing Words Test (identical to the pretest).

Analysis and Results

The population was divided into four groups for analysis of the data. Group 1 consisted of the Chicano students who were pretrained on the Arithmetic Reasoning Pretest. Group 2 was the Chicano students who were pretrained on the Missing Words Pretest. Group 3 was the non-Chicano students who were pretrained on the Arithmetic Reasoning Pretest. Group 4 was the non-Chicano students who were pretrained on the Missing Words Pretest.

	Pretrained on Arithmetic Reasoning	Pretrained on Missing Words
Chicano	Group 1 N = 26	Group 2 N = 35
Non-Chicano	Group 3 N = 35	Group 4 N = 40

A. Reliability of Tests

Before the data analysis was performed, all cases with missing test scores were omitted. An Item Analysis was performed on each

pretest and each posttest. The items in the Factors and Primes Posttest were divided into two scales: Scale 1 consisted of computation items, and Scale 2 consisted of higher cognitive ability (understanding) items.

The means and reliabilities (Cronbach's Alpha) of the Arithmetic Reasoning Pretest are shown in Table 1:

TABLE 1

	Reliability	Mean
Group 1	.568	4.520
Group 2	.258	3.971
Group 3	.588	5.343
Group 4	.579	6.075

From these results, it is clear that pretraining improved the reliability of the Arithmetic Reasoning Pretest for Chicano students but not for the non-Chicano students.

The means and reliabilities (Cronbach's Alpha) of the Missing Words Pretest are shown in Table 2:

TABLE 2

	Reliability	Mean
Group 1	.852	18.640
Group 2	.866	17.400
Group 3	.775	22.914
Group 4	.875	23.725

The Missing Words Pretest did not show improved reliability for either ethnicity or treatment group.

The means and reliabilities of the Computation Pretest, the Comprehension Pretest, and the Factors and Primes Pretest are shown in Table 3:

TABLE 3

	Computation	Comprehension	Factors and Primes
Group 1	α = .779	α = .767	α = .319
	mean = 12.760	mean = 9.720	mean = 2.72
Group 2	α = .649	α = .585	α = .147
	mean = 13.171	mean = 10.486	mean = 2.286
Group 3	α = .399	α = .515	α = .229
	mean = 13.943	mean = 11.257	mean = 2.657
Group 4	α = .460	α = .534	α = .568
	mean = 14.025	mean = 12.050	mean = 2.686

The students obtained very low scores on the Factors and Primes Pretest, which had 8 items. This indicated that they did not know the material contained in the Factors and Primes porgrammed texts.

Table 4 shows the means and reliabilities for Scales 1 and 2 of the Factors and Primes Posttest (First Achievement Test).

TABLE 4

	Scale 1		Scale 2	
	Reliability	Mean	Reliability	Mean
Group 1	.505	7.080	.243	3.480
Group 2	.613	6.314	-.039	2.600
Group 3	.719	9.371	.499	4.514
Group 4	.747	10.375	.577	4.825

The reliabilities of Scale 1 are all adequate for a criterion variable in this study. The mean scores of the Factors and Primes Posttest Scale 1 indicates that the students did learn some of the material in the programmed texts. The Factors and Primes Posttest Scale 2 is unreliable for the Chicano students.

The means and reliabilities of the Comprehension Posttest (Second Achievement Test) are shown in Table 5.

TABLE 5

	Reliability	Mean
Group 1	.746	10.400
Group 2	.795	8.914
Group 3	.472	11.429
Group 4	.892	10.925

B. Regression

After the item analyses, the Factors and Primes Posttest Scale 2 was eliminated from further analysis because of its low reliability.

Three stepwise regression analyses were then performed for the Factors and Primes Posttest Scale 1, the Comprehension Posttest, and the Missing Words Posttest. The independent variables in each of the

three stepwise regression analyses were: Arithmetic Reasoning Pretest, Missing Words Pretest, Computation Pretest, Comprehension Pretest, and Factors and Primes Pretest. The summary statistics for all the stepwise regressions are shown in Table 1 of the appendix.

Discussion

A. Pretraining

The analysis of the Arithmetic Reasoning Pretest indicates that pretraining significantly improved the reliability of this particular predictor test for Chicano students, but did not change the reliability for non-Chicano students.

There was no significant difference between the reliabilities for the pretrained and non-pretrained groups on the Missing Words Pretest for either ethnic group.

B. Regression

The regression analysis indicates that the Arithmetic Reasoning Pretest is the best predictor of achievement for the Chicano students (Group 1) who were pretrained on this test. The Arithmetic Reasoning Pretest correlates .67 with the Factors and Primes Posttest Scale 1 for Group 1 and correlates .40 with the Factors and Primes Posttest Scale 1 for Group 2. This is a strong indication that pretraining Chicano students on this predictor test not only improves the reliability but also improves the predictability of the test.

For Group 2, the best predictor was the Missing Words Pretest, which they had been pretrained for. The Missing Words Pretest correlates .72 with the Factors and Primes Posttest Scale 1 for Group 2 and correlates .55 with the Factors and Primes Posttest Scale 1 for Group 1. As previously stated, pretraining did not improve the reliability of this test for any group, but it appears to have improved the predictability of this test for Chicano students.

The Arithmetic Reasoning Pretest correlates .53 with the Factors and Primes Posttest Scale 1 for Group 3 and correlates .49 with the Factors and Primes Posttest Scale 1 for Group 4. The Missing Words Pretest correlates .31 with the Factors and Primes Posttest Scale 1 for Group 3 and correlates .52 with the Factors and Primes Posttest Scale 1 for Group 4. These results indicate that pretraining does not

improve the predictability of the Arithmetic Reasoning Pretest for non-Chicano students, but appears to have improved the predictability of the Missing Words Pretest for the non-Chicano group.

The results reported in this paper tend to confirm Bernal's findings: Chicano students benefit significantly on mental ability tests from an intervention which permits them to learn the test-marking strategies. Due to the small sample size of this project, the results cannot be generalized to the larger population of Chicano students. A replication of this study using a larger sample size is warranted.

APPENDIX TABLE 1

Stepwise Regression: Group 1

SUMMARY TABLE DEPENDENT VARIABLE 7 IST ACH SCALE I

VARIABLE NAME	VAR NO. REMOVED	VAR NO. ENTERED	STEP NO.	MULTIPLE R	RSQ	INCREASE IN RSQ	F VALUE TO ENTER/REMOVE	P	NO. OF INDEP VAR INCLUDED
PRE-ARITH REASONIN		3	1	0.6688	0.4473	0.4473	19.4200	0.0002	1
PRE MISS. WD		9	2	0.7290	0.5315	0.0842	4.1351	0.0537	2
PRE-FACTORS AND PR		6	3	0.7419	0.5504	0.0189	0.9256	0.3465	3
PRE-COMPREHENSION		5	4	0.7568	0.5727	0.0223	1.0952	0.3070	4
PRE-COMPUTATION		4	5	0.7593	0.5765	0.0038	0.1804	0.6756	5

Stepwise Regression: Group 2

SUMMARY TABLE DEPENDENT VARIABLE 7 IST ACH SCALE I

VARIABLE NAME	VAR NO. REMOVED	VAR NO. ENTERED	STEP NO.	MULTIPLE R	RSQ	INCREASE IN RSQ	F VALUE TO ENTER/REMOVE	P	NO. OF INDEP VAR INCLUDED
PRE MISS. WD		9	1	0.7165	0.5133	0.5133	31.6418	0.0000	1
PRE-ARITH REASONIN		3	2	0.7177	0.5151	0.0017	0.1039	0.7495	2
PRE-COMPUTATION		4	3	0.7185	0.5163	0.0012	0.0703	0.7928	3
PRE-COMPREHENSION		5	4	0.7199	0.5182	0.0019	0.1092	0.7436	4
PRE-FACTORS AND PR		6	5	0.7210	0.5199	0.0016	0.0890	0.7678	5

Stepwise Regression: Group 3

SUMMARY TABLE DEPENDENT VARIABLE 7 IST ACH SCALE I

VARIABLE NAME	VAR NO. REMOVED	VAR NO. ENTERED	STEP NO.	MULTIPLE R	RSQ	INCREASE IN RSQ	F VALUE TO ENTER/REMOVE	P	NO. OF INDEP VAR INCLUDED
PRE-COMPREHENSION		5	1	0.6138	0.3768	0.3768	19.9514	0.0001	1
PRE-ARITH REASONIN		3	2	0.6741	0.4544	0.0776	4.5509	0.0407	2
PRE-FACTORS AND PR		6	3	0.7303	0.5333	0.0789	5.2415	0.0290	3
PRE-COMPUTATION		4	4	0.7367	0.5428	0.0095	0.6220	0.4365	4
PRE MISS. WD		9	5	0.7374	0.5438	0.0010	0.0661	0.7990	5

Stepwise Regression: Group 4

SUMMARY TABLE DEPENDENT VARIABLE 7 IST ACH SCALE I

VARIABLE NAME	VAR NO. REMOVED	VAR NO. ENTERED	STEP NO.	MULTIPLE R	RSQ	INCREASE IN RSQ	F VALUE TO ENTER/REMOVE	P	NO. OF INDEP VAR INCLUDED
PRE MISS. WD		9	1	0.5152	0.2654	0.2654	12.6469	0.0011	1
PRE-ARITH REASONIN		3	2	0.6029	0.3635	0.0980	5.2362	0.0285	2
PRE-COMPREHENSION		5	3	0.6168	0.3804	0.0169	0.9017	0.3492	3
PRE-FACTORS AND PR		6	4	0.6380	0.4070	0.0266	1.4356	0.2394	4
PRE-COMPUTATION		4	5	0.6457	0.4169	0.0099	0.5261	0.4737	5

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